CLAIMS

1. A method of proliferating neuronal precursor cells, comprising contacting the precursor cells with an antagonist for a pituitary adenylate cyclase activating polypeptide (PACAP) receptor, PAC_1.

2. The method of claim 1, wherein the neuronal precursor cells are cerebral cortical precursor cells, subventricular zone precursor cells, or hippocampal granule precursor cells.

3. The method of claim 1, wherein the neuronal precursor cells are cerebral cortical precursor cells.

4. The method of claim 1, wherein PAC_1 has an amino acid sequence of SEQ ID NO: 3.

5. The method of claim 1, wherein the antagonist is $PACAP_{6-38}$.

6. The method of claim 5, wherein the antagonist has an amino acid sequence of SEQ ID NO: 4.

7. The method of claim 1, wherein the antagonist is max d 4.

8. The method of claim 7, wherein the antagonist has an amino acid sequence of SEQ ID NO: 5.

9. The method of claim 1, wherein the antagonist is non-metabolizable.

10. A method of inhibiting proliferation of neuronal precursor cells, comprising contacting the cells with a composition comprising pituitary adenylate cyclase-activating polypeptide (PACAP).

11. The method of claim 10, wherein the neuronal precursor cells are cerebral cortical precursor cells, subventricular zone precursor cells, or hippocampal granule precursor cells.

12. The method of claim 10, wherein the neuronal precursor cells are cerebral cortical precursor cells.

13. The method of claim 10, wherein PACAP has a nucleotide sequence of SEQ ID NO: 1 or an amino acid sequence of SEQ ID NO: 2.

14. The method of claim 10, further comprising adding an agonist for a PACAP receptor, PAC_1.

15. The method of claim 10, wherein PAC_1 has an amino acid sequence of SEQ ID NO: 3.

16. The method of claim 10, wherein the agonist is maxadilan.

17. The method of claim 16, wherein maxadilan has an amino acid sequence of SEQ ID NO: 6.

18. The method of claim 10, wherein the agonist is $PACAP_{27}$.

19. The method of claim 18, wherein $PACAP_{27}$ has an amino acid sequence of SEQ ID NO: 7.

20. The method of claim 10, wherein the agonist is VIP.

21. The method of claim 20, wherein VIP has an amino acid sequence of SEQ ID NO: 8.

22. The method of claim 10, wherein the composition comprising PACAP passes through the blood-brain barrier.

23. The method of claim 10, wherein the composition reduces DNA synthesis.

24. The method of claim 10, wherein inhibiting proliferation of the cells comprises inhibiting mitosis of the cells.

25. The method of claim 24, wherein inhibiting mitosis comprises blocking the G1-S phase transition in the cell development.

26. A method of promoting proliferation of neuronal precursor cells, comprising

providing an oligonucleotide consisting of a sequence complementary to PACAP; and

introducing the oligonucleotide into the cells, wherein the oligonucleotide decreases the expression of PACAP in the cells.

27. The method of claim 26, wherein the neuronal precursor cells are cerebral cortical precursor cells, subventricular zone precursor cells, or hippocampal granule precursor cells.

28. The method of claim 26, wherein the neuronal precursor cells are cerebral cortical precursor cells.

29. The method of claim 26, wherein the oligonucleotide is DNA, cDNA, RNA, or mRNA.

30. A method of promoting proliferation of neuronal precursor cells, comprising

providing an antibody that binds to PACAP; and

introducing the antibody into the cells, wherein the antibody decreases expression of PACAP in the cells.

31. The method of claim 30, wherein the neuronal precursor cells are cerebral cortical precursor cells, subventricular zone precursor cells, or hippocampal granule precursor cells.

32. The method of claim 30, wherein the neuronal precursor cells are cerebral cortical precursor cells.

33. A method of treating a medical condition caused by the proliferation of neuronal precursor cells, comprising administering a composition comprising PACAP to said cells.

34. The method of claim 33, wherein the neuronal precursor cells are cerebral cortical precursor cells, subventricular zone precursor cells, or hippocampal granule or glial precursor cells.

35. The method of claim 33, wherein the neuronal precursor cells are cerebral cortical precursor cells.

36. The method of claim 33, wherein PACAP has a nucleotide sequence of SEQ ID NO: 1 or an amino acid sequence of SEQ ID NO: 2.

37. The method of claim 33, wherein cell growth is inhibited.

38. The method of claim 37, wherein the cells are cancerous.

39. A method of treating a medical condition caused by the loss of neuronal precursor cells, comprising administering an antagonist for PAC_1 receptor to the cells.

40. The method of claim 39, wherein the neuronal precursor cells are cerebral cortical precursor cells, subventricular zone precursor cells, or hippocampal granule precursor cells.

41. The method of claim 39, wherein the neuronal precursor cells are cerebral cortical precursor cells.

42. The method of claim 39, wherein the PAC_1 receptor has an amino acid sequence of SEQ ID NO: 3.

43. The method of claim 39, wherein neuronal cell growth is promoted.

44. The method of claim 39, wherein the medical condition is a stroke, dementia, primary cortical degenerative disorders, sub-cortical degenerative disorders, infections, prion disorders, toxic and metabolic disorders, and brain injury.

45. A method of increasing brain tissue, comprising administering a PACAP antagonist to neuronal precursor cells.